

MECHANICAL SURGERY. 10

ARTIFICIAL LIMBS,

APPARATUS FOR RESECTIONS,

APPARATUS FOR UNUNITED FRACTURES,

FEET FOR LIMBS SHORTENED BY HIP DISEASE,

ARMS AND HANDS.

BY
SOLDIERS  PROVIDED
COMMISSION

OF THE

SURGEON-GENERAL U. S. A.

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696 BROADWAY, CORNER OF FOURTH STREET,

NEW YORK.

(REMOVED FROM CLINTON HALL, ASTOR PLACE.)

MECHANICAL SURGERY

AS A

SPECIALTY.

Of late years the importance of bringing the treatment with apparatus of mutilations and deformities under the immediate supervision and control of professional men has merited and received increased recognition. The application of trusses, the application of apparatus for spinal and hip diseases, are but a few of the many callings which the past ten years has seen transferred from the mechanic to the physician and surgeon.

Such disposition should be made of every practice which relates to surgery, and for which a scientific and practical knowledge of anatomy, physiology, surgical pathology, surgery, and therapeutics, in their most comprehensive sense, should be exacted. To commit the vital interests that are involved in an amputated or resected limb to a mere tradesman, who possesses no adequate appreciation of its condition, nor knowledge of what that condition indicates, is to trifle with the most serious matters. In every such surgical operation and its final results, the credit of surgery and the cause of humanity are too heavily staked to leave to uneducated and unappreciative men its final disposition. Empiricism can be no more consistently tolerated in surgical than in medical therapeutics. All surgical apparatus should be scientifically prescribed, constructed, and adapted to fulfill the special indications presented by each individual case, securing the greatest possible degree of restoration or amelioration, naturalness, comfort, and usefulness.

Irreparably damaged and diseased parts are to be well diagnosed; malignant predispositions, and morbid irritabilities well guarded; paralyzed, and morbidly contracted tissues, invoked by continuous passive exercise. With the laudable efforts which are being made by the best constituted surgeons in conservative

surgery, for the best interests of their patients, there should be a correlative intelligence, philosophical effort and result on the part of the specialist in mechanical surgery ; otherwise, the one practice renders the other a nullity.

The great advances in military and general operative surgery, the many new and modified operations resultant from the experience of the late war, and the demand upon mechanical surgery to meet with appropriate reparative apparatus the multiform mutilations and deformities, render the duties of its practitioner onerous yet honorable. The great variety of cases of resection, amputation, disarticulation, ankylosis, ununited fracture, &c., each peculiar in its individual requirements, calls for continuous study and the continued exercise of professional knowledge and scientific experience.

Of resection is this especially true. Of the many cases treated thus far, no two have been exactly alike either as to mode of operation or the nature and degree of functional disability. Hence the necessity of ascertaining in each case, by careful examination and experiment, the exact condition in which the parts are left—what nerves or muscles have been severed or injured, what actions lost or impaired, the length of bones removed, what muscular contraction has taken place or may be expected, and the possibility of any future reproduction of the bone, and what modified apparatus is required. By the contemporaneous treatment of a greater number and variety of special cases than would come within years of the most extensive surgical practice, the opportunity is presented of making direct observation of the comparative safety and success of different operations, and those most favorable to the restoration of lost powers both by nature and by art.

The collection and classification of data, while necessary in each individual case for its proper treatment, is of still greater value to the profession, and constitutes a powerful argument in favor of their lending their patronage and influence to the physician or surgeon who earnestly and faithfully devotes himself to this specialty.

The surgical statistics that have been demanded by the Surgeon-General U. S. Army, of those who have had the mechanical treatment with appliances of the many thousands of cases of mutilations which the late war caused, fully illustrates the soundness of the foregoing premises.

ARTIFICIAL LIMBS.

THE ARTIFICIAL LIMBS furnished and applied by myself, personate all of the essential anatomical formations and physiological functions of the natural leg, in general configuration, formations of knee, ankle, and toe joints; of muscles and tendons of the foot, leg, and thigh for flexion and extension, for walking, standing, sitting, horseback-riding; for elasticity, naturalness of dress, action, and usefulness. It has been designed by my own study to fulfill every indication created by operative surgery or the pathological condition of retained parts.

Surgical appliances, when therapeutic, prove inestimable substitutes and auxiliaries to nature. To be such, they must, to a greater or less degree, compensate lost parts and functions, and restore those which are impaired. All disease is not remediable, neither are all mutilated limbs or impaired functions restorable. A very large majority of amputated limbs are compensable to a useful extent; in very many instances so completely as to render the operation comparatively trifling, and to challenge detection. Ankle-joint amputations, for instance, are scarcely appreciable, so appropriate is the mechanical treatment and perfect the restoration. Of the leg and knee-joint amputations, a lesser but very great restoration is experienced. The improvements in amputations of the inferior extremities, and the extent to which artificial legs have been brought to simulate the natural ones, indicate an advancement in philosophy and art.

The extreme loss of the thigh in continuity, and even in contiguity of the great trochanter, is remediable to a very useful extent, depending largely upon the sthenic powers, skill, and perseverance of the patient, as the following CASE illustrates, viz.:

J. C., private 104th Reg't N. Y. Infantry, suffered an amputation of his thigh in its upper third, leaving a stump of only two inches' length. His condition and habits rendered him one of the most unpromising patients at the Central Park U. S. General Hospital. The surgeon in charge, and staff, however, decided that the experiment should be made for his benefit. By a studied and persevering effort, a limb was successfully applied in July, 1864. With a little initiatory practice, he soon became an object of admiration, astonished the entire medical corps and inspector, by his expert and natural locomotion. His ready perceptions and indomitable will greatly compensated his extreme physical disad-

vantages. He was discharged a little time after the limb was applied, immigrated to northern Illinois, where he is at work getting out bedstead timber and running a buzz saw. He wrote in July, 1866, that he seldom used a cane (only for long walks), carried his timber in and out of his mill, and that he was prepared to compete in walking with any one who had suffered a thigh amputation, even though possessed of a more favorable length of stump.

ADAPTATION OF ARTIFICIAL LIMBS.

The adaptation of artificial legs by adjustable and thickly padded sockets, inserted into wooden, metallic or rawhide sockets, is always prejudicial, by the heat thus generated, and debilitating effect upon the stumps. Profuse perspiration is induced, and the fomenting process effects a softened, parboiled state of the skin and cicatrix, with a debility that often extends to indolent ulcerations.

The sockets for stumps should always be solid. They should be carefully adapted to the angles, protuberances, crests, and every irregular shape and pathological condition of the stump, by the nicest manipulations. Their lining should be, generally, only one thickness of fine soft flannel—a material less calculated to irritate the skin than any other fabric. The socket should be well ventilated.

The health and efficiency of stumps, after having become thoroughly healed, depends much upon the sanitary treatment by the patient.

The utility and satisfaction afforded by an artificial limb will depend much upon the anatomical and physiological principles which govern its construction. An artificial leg that is constructed without naturally constituted ankle and toe-joints, extensor and flexor tendons of the foot and toes, is radically and essentially defective.

ANKLE-JOINT MOTION.

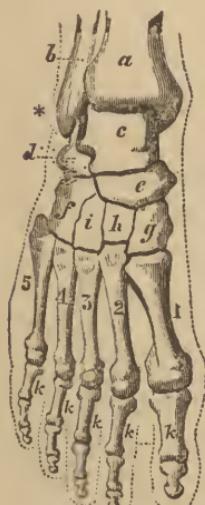
The Tibio-Astragaloid ankle-joint, which I instituted several years ago for artificial legs, is the closest possible imitation of the Tibio-Tarsal ginglymoid joint of nature, in its exact formation and action. Its opposing articular surfaces are composed:—the inferior of hard sheet brass over the astragalus; the superior of thick lubricated leather over the concave articular surface of the Tibia.

These opposing surfaces are not subject to corrosion, impediment of motion, or noise. The foot has all the elasticity, lifelike action, and adaptation to irregular surface as the natural foot, which never accommodates a grade nor obstacle with impunity. Arthrodial and semi-rotary motions pertain exclusively, in principle and action, to the head of the femur, mediotarsal, and metatarso-digital joints of the inferior extremity.

The ankle-joint is purely a hinge one—as a careful and critical dissection will demonstrate—and every lateral motion which is introduced into the ankle-joint of an artificial leg is a violation of anatomical and physiological principles. The text books of all anatomists and physiologists, which are received authorities, bear witness to the correctness of the above premise, viz. :—

PHYSIOLOGICAL ANATOMY OF THE ANKLE-JOINT.

BONES OF THE FOOT AND ANKLE-JOINT.



a and *b*, Inferior Extremity of the Tibia and Fibula; *c*, Astragalus; *d*, Os Calcis; *e*, Scaphoid; *f*, Cuboid; *g*, Internal Cuneiform; *h*, Middle Cuneiform; *i*, External Cuneiform; *1, 2, 3, 4*, and *5*, First, Second, Third, Fourth, and Fifth Metatarsal Bones; *k, k, k, k, k*, Phalanges of the Toes; ***, Ginglymus joint of the ankle.

“The form of the Astragalus is that of a pulley which, of course, admits of but one direct motion, viz. : forwards and backwards. Its sides are plain, smooth, and flat, and closely locked in by the inner and outer ankle, so as to prevent luxation or awkward motions to either side.

“The two points (malleoli), projecting so as to enclose the bones of the foot, making a pure hinge, prevent all lateral motion; make the joint firm and strong, and will not allow of luxation, till one or both ankles be broken.” (BELL.)

“The movements of the ankle-joint are limited to flexion and extension. There is no lateral motion.” (HENRY GRAY.)

The premises of Mr. Ward—Human Osteology—are so philosophical and demonstrative as to induce me to quote them at length; viz., “The articulation of the ankle is a ginglymus or hinge joint. It is effectually secured from lateral dislocation by the projection of the malleoli, which descend, one on each side of the Astragalus, forming a sort of box for its reception, &c. Another provision, tending to maintain the bones firmly in their rel-

ative position, consists *in the shape and adaptation of the opposed surfaces*. The trochlea of the Astragalus presents a median groove, and two lateral elevations, respectively receiving and received into a median ridge, and two lateral depressions on the terminal surface of the Tibia. In the median position of the foot, when it rests horizontally on the ground, the Astragalus receives the pressure of the Tibia at right angles, and none of the ligaments of the ankle-joint are put upon the stretch—a circumstance which may be noted as one of the conditions on which the aptitude of man for the erect posture depends. From this median position the foot is raised in flexion, and depressed in extension.

In *flexion*, the wide anterior extremity of the trochlea of the astragalus is brought between the two malleoli, and completely fills the intervening space; so that in this attitude *no lateral movements of the joint are possible*; but, in *extension*, the narrow posterior extremity of the trochlea comes between the malleoli, only partially filling the space bounded by those processes; so that in this posture of exteusion only *slight rotary movements, by which the toes are pointed a little inward or outward, may be performed.*" (No lateral motion of ankle.) "This I take to be the true explanation of the fact that the trochlea of the Astragalus is narrower behind than before. Bourgery attributes to the ankle-joint movements of adduction and abduction, by which the sole is turned inward or outward. Each of these movements would involve partial separations of the opposed surfaces; so that the Tibia would touch the Astragalus on the inner side only in adduction, on the outer side only in abduction."

"I have satisfied myself by repeated observation that the ligaments permit no such separation of the bones; which even, if possible, would probably injure the joint by causing an undue accumulation of pressure on particular points of its articular surfaces." Those who indulge the idea of Bourgery respecting adduction and abduction, lateral motion of the ankle-joint, will surely correct themselves of the error by careful dissection and a studied examination of the matter.

ARTIFICIAL KNEE-JOINT.

The condyloid knee-joint I some time since instituted for knee and thigh amputations constitutes a new and essential adjunct to an artificial leg, particularly for the treatment of those cases of amputations at the extreme upper third of the leg, which require

a knee-supporting leg; and of the knee-joint with thigh and leg parts of the natural length. The same is applicable for thigh stumps, when of extra length, the amputation being in immediate proximity to the condyloid enlargement. The trunnion-joints used for such occasions are so arranged as to leave the interior and lower part of the thigh socket, and the supporting parts of the knee-bearing leg, free of all interference with the end of the stump or the knee-supporting basis.

AMPUTATION OF THE INFERIOR EXTREMITIES.

RADICAL PRINCIPLES.

“You shall cut off as little of that which is sound as you possibly can; and so that the patient may most fitly use the rest of his leg, by walking on an artificial leg.”—*Paré*.

Notwithstanding the above axiom was enjoined three hundred years ago, it is not unfrequent, even now, that the principle relating to conservatism, and that like unto it, the subsequent usefulness of the patient with “the rest of his leg,” and the most useful artificial leg, are inexcusably and culpably violated, particularly so on the persons of the poor!

CASE.—I have a patient at this time, with amputation of the shaft of the femur, in whom the extent of disease was not such as to have required a removal of its condyles, which would have been of the greatest service to him, a poor laboring man.

It is an important fact to be considered that those who are poor now may soon become rich, and *vice versa*.

ANOTHER CASE.—An enterprising lady, residing in this vicinity, now well to do by the avails of her own efforts, suffered an amputation of her leg at its upper third, when she was both young and poor, and regarded a proper candidate for a “peg leg;” while the sound parts admitted of the amputation at the lower third, with which she might now use an appliance that would render her loss comparatively trifling. The favor with which the moral sense of her surgeon is regarded will be seen intuitively. This case is no exceptional one. Similar disregard of the comfort and usefulness of such subjects is often manifested in the still frequent cases of Chopart and tibio-calcaneum operations.

SOCIAL AND ECONOMIC CONSIDERATIONS.

Laboring men and women comprise a very large majority of those who suffer amputation of the inferior extremities; most of

them obtain artificial legs to compensate their loss, and thus are enabled to pursue their usual vocations. Of this class nearly one-half obtain limbs by the gratuities of the sympathizing and considerate, who entertain the philosophical principle that their interests are involved in the interests and greatest usefulness of their suffering neighbors.

In every such instance they are the benefactors of mankind who contribute to the greatest usefulness and happiness of the mutilated, and who, by their moral and scientific efforts, both *conserve* and *restore*. Such, in brief, are the considerations which every surgeon should magnify while determining an amputation.

VARIETIES OF INCISIONS AND THEIR RESULTS.

More diverse views and practice do not exist than respecting the best modes of amputating to secure the most useful stumps. The great variety of operations performed in the United States military service during the war, and in civil practice, which have been presented to my observation for final treatment, indicate an undetermined general rule.

The most creditable and serviceable stump that I have observed, viewed in its every feature, has been the product of the bilateral-tegumentary flaps, and circular incision of the muscles. A strongly formed and scarcely perceptible cicatrix is effected by more or less of primary healing. It secures a smooth, round, and finely-composed end; and generally there is an equal retraction of the muscles. Its symmetrical proportions and healthy tone render it an admirable work of nature and art. In no instance, when sloughing and other unfavorable events have not occurred, has the final result of this method been otherwise than gratifying. The results of the circular and bilateral varieties singly have been eminently superior to those of any other, excepting their compound. Agreeably to my personal observation, the bi-lateral operation is the most favorable to a primary union, in general or in part. I judge it to be favorable, also, to make speedy secondary union, by the drainage it affords and escape of sanguineous and purulent matter. It will, I venture to predict, eventually be adopted in all amputations of the leg and thigh in the continuities.

THE PLACES OF INCISION.

No practice of surgery is possessed of greater interest, or of more practical importance, than an amputation of the inferior

extremity ; and yet no other part of the human system is subject to so much bad surgery.

In the cases where conditions have been equal, and surgeons were favored with the choice of site for the greatest good of their subjects, the diverse places and variety of their operations have borne witness that no rule of economy governed their choice.

Mr. Ferguson has, with cause, styled much of surgery *a fashion* ; to operate at one period just above the malleoli ; at another, near the tuberosity of the tibia ; and at other times, at all of the intermediate places, regardless of the good or evil results to their patients.

Such factitious practice, I judge, must be influenced more or less by the unphilosophical ideas entertained respecting the manner of compensating the loss of limb with apparatus.

It is an unfrequent exigency that requires an amputation of the leg or thigh so extreme as to prevent the application of useful apparatus of a compensating character. For the greatest benefit of the subject

THE FIRST PLACE OF ELECTION

is the ankle joint—a place that can never be disregarded with impunity—and by Mr. Syme's method.

ANKLE-JOINT AMPUTATIONS.

No amputation of the inferior extremity can ever compare, in its value to the subject, with that of the ankle-joint originated by Mr. Syme. Twelve years of experience with that variety of operation have afforded me assurance that it is “a fact complete,” not capable of being improved in its general character. It is scientific, practically of the utmost use, and subservient to the best interests and happiness of the patient.

Mr. Ferguson avowed that he “knew of no kind or style of amputation which deserved more high considerations ; and so far as the subject is concerned, it is one of the greatest improvements in modern surgery.” No other operation has resulted so beneficially and satisfactorily. The subjects of such an amputation scarcely realize their loss, with legitimate appliance. They appear every way whole. The sensations of the stump are normal ; the articular surface and thickened tissues are accustomed to the

hardest service, and to bear the heaviest burdens, which, with apparatus, enables the patient to engage in his accustomed walks and vocations with unabated naturalness and endurance. One gentleman, for whom I applied a foot, has walked thirty-five miles in a day, on a hunting excursion, while his companions did not suspect that he was otherwise than whole. So beneficent have been the results of this operation as to have induced many a sufferer from congenital malformations, varieties of talipes, and troublesome Chopart operations, to demand it as an "amputation of convenience."

It is an operation that has for its support the soundest principle of surgical economy.

It retains, in addition to the entire length of leg, nature's foundation—the articular portion of the shaft of a long bone—as a base of support.

Its accustomed service is concurrent and coequal with that of the calcaneum, to sustain the weight and forces of the body which are reflected to it.

To remove the calcaneum, and to substitute the articular base of the tibia, is merely a change of place, not of its functions.

A cogent reason in support of amputation of the ankle-joint is, that to the compacted hardened tissue of the lower termination of the tibia are transferred and united, for a cushion, the thickened tissues, which have effectually served to protect the os calcis.

The place of those tissues is changed; their accustomed function is unchanged and normal.

When the change of base and healthy union of the hard and soft parts are successfully perfected, the same condition and serviceableness of the end of the stump are gained as that of the natural heel. After a very short period of exercise the sensations become perfectly natural, and the end of the stump as enduring as the heel of the natural foot.

I have been led to a very great interest and persistent advocacy of Mr. Syme's method by a regard for the humane principles of rational conservatism, and by the numerous cases of ankle-joint amputations which have demonstrated to me the superior utility of that operation to any amputation of the leg, or any modification of the general one of Mr. Syme. Of fifty recent cases which have come to my hands for final treatment by mechanical means, not one has failed of a highly gratifying success. Both patients and surgeons who have witnessed their results have been every

way pleased with their exceeding benefit. Not every subject is in immediate condition for the adaptation of apparatus, for reasons that will readily be apparent to every surgeon.

Some require treatment for ulcerations, thickened tissues, swellings, and tenderness; others require some inuring treatment, before the application of apparatus. In no instance do I venture to apply apparatus until the patient can endure the end of the stump upon either the bare floor or some unyielding support with ease.

Those leg-makers who have only stereotyped apparatus to apply indiscriminately for amputations in the continuity of the leg, and who find this new method incompatible with their highest ideas, have, to my personal knowledge, treated such cases by apparatus as for amputation, which allows no weight at the end of the stump, but distributes it upon the walls of the leg, beneath the head of the tibia, and up around the thigh.

Those who have no discriminating knowledge of surgical operations, nor of physiological, anatomical, and pathological principles, can hardly be expected to appreciate and sustain an amputation of the ankle-joint; nor can they treat it legitimately with apparatus which fulfills the design of such an operation.

To illustrate: Captain —, who had suffered an amputation of the ankle-joint—Syme method—came to this city and applied to — for apparatus. He was informed that, because of a slight prickling sensation when he rested his stump on the floor, it should not receive any weight at its end. An artificial leg was applied, as in ordinary cases of leg amputation; to take the weight of the body upon its walls and the thigh, so as to suspend and relieve the end of the stump. The Captain entertained the plea of tenderness as valid; but being very greatly annoyed by the weight and irritation of the apparatus, he sent for a surgeon of this city, who, upon examining the stump and appliance, immediately transferred him to me. I found his stump admirably well formed and healthy, except a little prickling sensation produced by hard pressure.

After ten days of preliminary treatment, during which a case-ment and foot were fitted, and trials made, the prickling had entirely subsided, the natural sensation of the heel was restored, and the patient went out walking without inconvenience. The sensation of prickling is no unusual complaint for persons to make

who have suffered an injury of the tissues of the heel or foot, when they have so far recovered as to begin to exercise the part.

It is a mere temporary sensation which exercise soon converts into a normal one. The objections to Syme's operation—tenderness, unsoundness and unreliableness as a basis of support, after the stump has become well healed—are entire gratuities without cause.

The practice of Mr. Syme (original method) to exsect the indurated tissue, the most depending and most serviceable feature of the tibia, thereby exposing the cancellated structure, and also to remove the malleoli through their base on a level with its articular surface, is unphilosophical and inexpedient. The increased vascularity of the cancelli must necessarily conduce to protract the tenderness of the face of the stump. Some surgeons strive to enlarge the base of support afforded by the tibio-tarsal surface by sawing the malleoli off, at a line transverse with the end of the tibia; but the practice is entirely gratuitous, and in some respects prejudicial.

The inter-malleolar space is the only true and all-sufficient base of support; any additional surface is superfluous; and by increasing the periphery of the end renders it unduly large for the adaptation of symmetrical apparatus. The articular surface should not be molested. The malleoli should be exsected with the saw, at a beveling angle of some forty degrees. The most serviceable and best proportioned stump is thus composed. With the dense ivory structure, the cancellated and medullary tissues all preserved, other matters being equal, we may rationally anticipate the best results. The modified variety of Baudens, the dorsal flap, or that of Roux, lateral flap, will never be chosen varieties, but adopted as dernier resort only. Even when the operation is thus modified, the stump is eminently superior for utility, and the entire pressure upon its face, to any amputation of the leg.

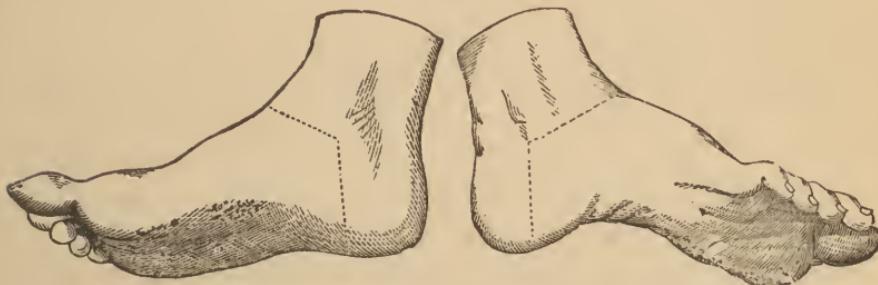
I have had two cases of the bilateral-flaps variety, made for want of plantar tissue, and cicatrized over the end of the stump, and one of the dorsal variety, upon each of which the patients bore their entire weight, with an artificial foot, with the utmost comfort.

"The following wood-cuts, of reduced size, taken from similar illustrations in the *Monthly Journal*, February, 1850, of Mr. Syme's mode, give a more correct idea of the line of incision than can any verbal description. It will be seen that they differ very materially from those given in text-books.

“Accidents.—The principal precaution to be observed is in the dissection on the posterior part of the os calcis, in order not to wound the posterior tibial artery, and thus deprive the flap of its nourishment.”

This operation is perfected by beveling off the malleoli, which favors a perfect symmetry of the part constituting the ankle of the mechanical appliance.

The cut represents the stump of Syme's operation, which enables the subject to take his support on its end, the same as on the natural heel.



The compensative apparatus I have been the first to originate and apply in the United States; nor am I aware of any like legitimate treatment abroad.

With it I have invariably made the face of the stump the basis of entire support, and with no intervening substance, other than one or two thicknesses of soft flannel cloth. The apparatus is composed of a light semi-cylindrical wooden case for the leg, receiving the bulbous end of the stump in a concavity, at its lower end, fitted snugly to the posterior half of the parietes of the stump and leg for two-thirds of its length, while its base is entirely supported. Wide leather bands lace up over the anterior half of the leg, to keep it in situ.

The case is strengthened with strong hickory pins, so dovetailed as to prevent its splitting or yielding to the weight of the body. To the leg and stump case an artificial foot, of natural size and shape, is attached by a strong ginglymus ankle-joint, on a line nearly parallel with that of its mate. An artificial tendo-achillis passes up from the heel, through an inclosed groove into the calf of the casement, where it is strongly inserted. It preserves the



Resulting Stump,
Photographed.

foot at a right angle with the leg part, when the weight of the body passes over and forward upon the ball and toe-piece of the foot. The latter is made to hug the ground, the same as the toes of the natural foot, by a strong lever and rubber spring. When the heel strikes the ground, the anterior part of the foot is depressed, but elevated sufficiently by rubber flexor springs, when the weight is off, to prevent tripping. The apparatus is covered with green rawhide, dried and contracted on, and coated with a neat flesh-colored enamel. It may be dressed with stocking, shoe or boot, at pleasure, the same as its fellow.

With its application the patient is, to all appearance and for usefulness, restored to a normal condition.

I repeat: The great and important feature of the Syme operation at the ankle-joint is the natural, philosophical basis of support which the method retains, and the opportunity it affords, by a sufficient shortness, for the adaptation of a compensating artificial foot, and a ginglymus ankle-joint in a proper place.

The main and defensive feature of M. PIRIGOFF's modification is the increased length of stump, created by the excision of the tibia and calcaneum, and the annexation of a greater or less portion of the latter to the former, for the service of the "*poor man*," with the application of a "bucket" or "boot."

Every physiological anatomist must readily perceive that the increased length of the stump, by an adventitious portion of the *os calcis*, will, in the ratio of its increased length, necessarily impair it for the application of legitimate mechanical appliance.

Statistics furnish abundant evidence that it possesses no superior advantage as relates to mortality, sloughings, necrosis, or other untoward events, over the Syme method; *nor even as a reliable basis of support*; only to secure the benefits of an *os-pegleg*—the similitude of the wooden relic of barbarity.

Science having for its true object practical and humane use, it becomes unwise for men to exercise their brains for unscientific purposes.

The special interests of the subject of an amputation of the inferior extremity are the matters of importance—"and how the patient may *most fitly* use the rest of his leg by walking on an artificial leg." No artificial leg has, nor can be constructed and adapted to any stump of the leg, having its parietes for support with such perfect favor, as that which I originated and adapt for ankle-joint amputations. The same apparatus, modified, may be

applied to the Pirigoff modification, but the result is far less satisfactory.

I never have a patient of a Syme amputation make use of a cane, nor walk in any other than the most natural gait. There is one condition of the ankle-joint in which the Pirigoff method may be adopted for the very great benefit of the patient, viz.: Where caries, necrosis, or injury of the tarsal end of the tibia, preclude the possibility of the Syme method, and would render the Pirigoff method a valuable alternative to an amputation of the leg at its lower third. In any such event, to excise the diseased tibia, and a sufficient amount of the calcaneum, and annex to the tibia to compensate its loss by excision, would be an additional fact to surgical improvement—a worthy expedient—but only as an alternative to the leg amputation. It would make the leg of normal length, and alike serviceable as a Syme case for the adaptation of a befitting apparatus.

The following is the expression of a Committee of the Medical Members of the Sanitary Commission on the subject of amputations of the foot and ankle, viz.:

“Of the amputations through the tarsus, or at the ankle-joint, preference should be given to Syme’s operation, as affording a minimum mortality, with a stump best adapted to an artificial limb. An artificial limb may be applied to a Syme’s stump, which both relieves deformity and renders the patient’s gait free from the slightest halt.”

Signed,

STEPHEN SMITH, M. D., *Chairman.*

VALENTINE MOTT, M. D. ALFRED C. POST, M. D.

GURDON BUCK, M. D. WILLARD PARKER, M. D.

JOHN WATSON, M. D. ERNEST KRACKOWIZER, M. D.

W. H. VAN BUREN, M. D.

The same sentiments as above expressed are entertained by the first surgeons of this city and country.

THE OPERATION is performed by surgeons who are familiar with the minute anatomy of the foot and ankle, and the work of the operation with as great facility and ease as any amputation of the inferior extremity.

The numerous operations I have witnessed have been performed in a brief space of time, with precision, and invariable

success, though the diseased condition of some rendered the prospects of success very unfavorable, and taxed the skill of the surgeon to secure sufficient healthy tissue for flaps to cover the end of the stump.

The reported failures in military practice were no greater than it were rational to expect, and should not influence surgery in civil practice.

The healing is often primary. I know of several cases that have been cicatrized in thirty days' time; and in sixty days were traveling, the same as with natural feet, without canes, or halt in their gait.

FINAL RESULTS.

ILLUSTRATED WITH CUTS.

These cuts, engraved from photographs, represent the case of Kate Riley, described in the letter of Dr. Stephen Smith. The graceful appearance of the apparatus when dressed, and the fact of her having performed the duties of hospital nurse for many years, are the best of testimony to its ingenuity and utility.



SYME'S OPERATION WITH APPARATUS.

APPEARANCE WHEN DRESSED.

THE INTRODUCTION OF SYME'S OPERATION INTO AMERICA, AND ITS
FIRST TREATMENT WITH SURGICAL APPARATUS.



FROM PHOTOGRAPHS OF STUMP AND
ARTIFICIAL FOOT.

improvements he has added to mechanical surgery.

Believe me, dear Doctor,

Very truly yours,

J. M. CARNOCHAN,

Professor of Surgery, &c. &c.

To Dr. J. SIMONS, U. S. A. &c.

THE SECOND PLACE OF ELECTION

Is in the continuity of the leg, at the junction of its lower and middle thirds; by measure, nine or ten inches from the lower edge of the patella.

With well-formed and cicatrized bilateral flaps, the muscular insertions and powers being retained, the most serviceable stump of the leg is secured.

With such a stump of the leg, and appropriate apparatus, adjusted to its parietes—angles and crest—in a manner to distribute

LETTER.

DR. J. M. CARNOCHAN to DR. J. SIMONS, U. S. A., *President of the Board for the Examination of Artificial Limbs for Soldiers and Sailors, and Medical Director, Richmond, Va.:*

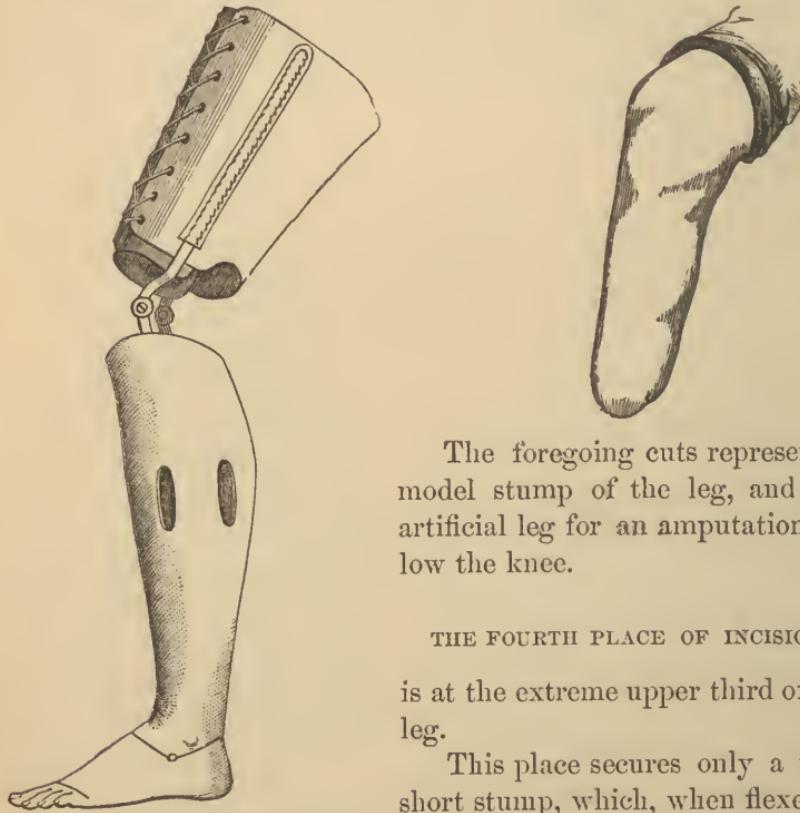
14 EAST 16TH ST., N. Y., April 15th, 1865.
My Dear Doctor:

Dr. Hudson has just recalled to me a fact, which I very willingly confirm, that he is the first to have given attention to the mechanical means suited to meet the conditions of the lower limb, after amputation through the ankle-joint, known now as Syme's operation. Having been a pupil of Mr. Syme, on a more recent visit to Edinburgh, Syme was, at that time, engaged in introducing this operation, and soon after my return to this country, about 1852 or '3, I introduced the ankle-joint operation, I believe, for the first time here. Dr. Hudson, in 1854, adjusted one of his pieces of mechanism on one of my patients much to my satisfaction. I make this statement, wishing to render justice to Dr. Hudson, believing, as I do, that he merits much credit for the various ingenious

the weight of the body equally over its entire surface, in locomotion, the final success is secondary only to the sequelæ of the ankle-joint amputation.

THE THIRD PLACE

To be elected for the amputation is at the junction of the middle and upper thirds, at a point three and a half or four inches from the lower edge of the patella. That is the highest part at which an amputation can be safely made, to have the artificial leg applied with a stump socket, and to retain therewith the use of the natural knee-joint. Such a length of stump, when well composed, and treated with the application of apparatus, does very satisfactory service. The use of the natural knee-joint is thereby secured to the patient, who appreciates its inestimable value. *As a matter of course*, when amputation is required to be performed above the lower third, every available part of the MIDDLE THIRD OF THE LEG will be sacredly retained!



The foregoing cuts represent a model stump of the leg, and the artificial leg for an amputation below the knee.

THE FOURTH PLACE OF INCISION

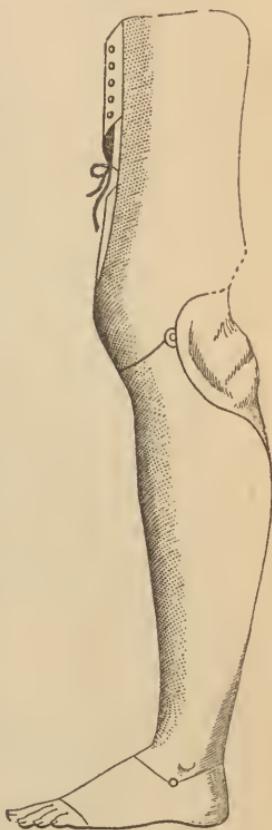
is at the extreme upper third of the leg.

This place secures only a very short stump, which, when flexed at a right angle with the thigh, makes a valuable knee support for

the application of a leg, with an exceedingly useful artificial knee joint.

But the humane principles of modern surgeons have decreed this part to be no longer, as formerly, “*the place of election* ;” only to be accepted when disease or injury imperatively require it. Even where occasion occurs for an amputation at the upper third of the leg, it is no longer necessarily associated with the subsequent use of a “*peg leg* ;” for in the great advancement of operative surgery, therapeutic agencies have kept equal pace. Instead of the uncouth and cumbersome *stick* appended to the flexed knee, a very philosophically constructed limb is prescribed and adapted, which personates the natural leg in form, length and joints, and in movements, utility and comfort.

In amputations of the leg, in proximity to the knee joint, the stump should be flexed at once at a right angle with the thigh, to anticipate the result of any affection of the knee joint which may subsequently arise. I have had to contend with several very bad cases, in the adaptation of limbs, because the surgeon neglected to flex the stump, which resulted in a complete ankylosis of the knee joint, with the stump in an extended position. The face of such a stump being intolerant of support presents an unfavorable condition of limb for the best of treatment.



THE ACCOMPANYING CUT REPRESENTS THE KNEE-SUPPORTING ARTIFICIAL LEG.

AMPUTATION THROUGH THE KNEE-JOINT.

This operation may wisely be regarded one of the greatest and most humane improvements of modern surgery, when the benefit of the patient is taken into account. It is greater, in fact, than the very great one of Mr. Syme at the ankle-joint. For when we consider the comparative disability, from an amputation in the

continuity of the thigh, and that from a leg amputation in the continuity, the importance of the knee-joint amputation, as an alternative for the former assumes its true magnitude.

Amputation of the knee-joint is vastly superior to one of the thigh in the facilities afforded for the practical application of apparatus and its subsequent reliable use. With credit to conservative surgery, many eminent surgeons have revived, with modifications and improvements, the ancient operation of disarticulation of the knee-joint. They have attained a success which fully demonstrates its safety, while subsequent treatment, with improved and appropriate artificial limbs, determines its superior utility and beneficence. When the condyles of the femur are well provided with a long anterior or posterior flap, firmly united with corresponding short flaps, with or without the retention of the patella, the base of support which they present is pre-eminently superior to any possibly to be gained by a thigh stump from its walls and parts beneath the os ischium. The fitness of the articular surfaces, when clothed with a long anterior or posterior flap, or even with anterior and posterior flaps united and cicatrized over the face of the condyles, for such mechanical pressure as is experienced from the weight of the body, in the application of the artificial limb, must at once impress the anatomist and physiologist as natural and rational.

My experience in the treatment of many such cases, when contrasted with that in the treatment of a far greater number of thigh amputations, affords me the strongest evidence of the vast superiority of the condyles of the femur over the walls of the thigh for support and for locomotion.

The exhibition of two cases of disarticulation of the knee to the Board of U. S. Surgeons, commissioned to examine and approve artificial limbs and surgical apparatus, had the effect to conquer their pre-established prejudice to that operation and to create a lively interest in its favor. With a well-adjusted thigh piece arranged to fit the condyles and fossa, and with trunnion bolts to attach the leg and compose an artificial knee-joint, without elongating the thigh beyond its fellow, the patient is very perfectly compensated in his loss. The retention of the entire thigh for leverage is thus secured, and proves an inestimable advantage.

Of the varieties of flap the long anterior has presented the best results. It affords a smooth surface to the base, where pres-

sure is in excess, and to the anterior angle which is the point of application of the lever power for the propulsion of the leg forward in taking the step. The posterior angle, less subject to pressure and irritation, is the location suitable for the cicatrix.

The retention of the patella, so long regarded as an essential and conservative feature in this operation, is of indifferent expediency. When it is retained *in situ* it affords a graceful contour and smooth surface to the stump, and some addition to the base of support. But in a majority of cases the patella is retracted upon the anterior aspect of the thigh. In the operation the condyles of the femur should not be unnecessarily excised. It has been fairly demonstrated that the articular surface of the condyles affords a more ready and reliable support than cancellated tissue, and that it interposes no obstacle to a union of the various tissues, nor to healthy cicatrization.

To excise the epiphyses of the condyles, on a level with the superior surface of the intercondyloid fossa, to enlarge the basis of support, is altogether a gratuity, if not prejudicial. It is a gratuity as respects the base of support, and the adaptation of an artificial limb, which affords concavo-convex surfaces corresponding to those of the condyles, and may prove pernicious by injury to the tissues, and their consequent protracted tenderness.

THIGH AMPUTATION.

While this operation inflicts a greater degree of disability than any other of the inferior extremity, yet, with suitable means, the



The above cut illustrates knee-joint amputation with artificial leg applied.

impairment can be largely compensated, and the subject is able to re-engage in ordinary pursuits.

Much of the ability of one who has suffered a thigh amputation depends not only upon the place of the operation, its successful issue, a well-arranged and adapted artificial limb, but also upon his energy and spirit of enterprise.

The *choice of place* for the incision is at the junction of its lower and middle third, measuring a length of ten inches from the trochanter major, or from the perineum. The most perfect stump is composed by the bilateral or the circular operation, or a modified variety, the union of the two—care being exercised so as not to have the angle extend up upon the anterior aspect of the stump, but mostly upon the posterior. The artificial leg should represent the general formation and functions of the natural leg, and be so applied as to yield full obedience to the retained powers of the stump.

The disparity in manner of locomotion, between those wearing artificial limbs, is not always occasioned by the greater or less physical advantage they possess; neither by the quality of the artificial limb they use. Some men are natural acrobats, can readily and perfectly balance. Others are easily trained to a graceful and easy movement, have precision and enterprise. But others are timid, irresolute, despairing, and lacking those happy faculties, which generally insure the more creditable performance and greater usefulness.



LEG FOR THIGH STUMP.

SANITARY ADVICE.

When the stump of a thigh or leg has long been kept in a flexed position, and the flexor muscles are morbidly contracted, a continuous and persevering effort should be practiced to extend the stump till the patient regains a natural command of it, and the movements of the joints are entirely free. When the parts of the stump at its middle, or below, are larger in circumference than

at the upper, they should be gently bandaged, and the bandage be renewed every night and morning, to reduce it to a tapering form for the better adjustment of the socket of the artificial leg, and also to compact the soft tissues when they are loose and flabby.

To quicken circulation, to restore healthy tone, to relieve irritability or torpidity, cold and flaccid conditions of the stump, resort should be made to frictions with the hand or flannel, stimulating lotions, cold affusions, in connection with a flannel roller.

SURGICAL SPLINT FOR UNUNITED FRACTURE OF FEMUR.

(Extract from Hamilton on Fractions and Dislocations.)

“ As a means of combining immobility with compression and healthy exercise, the apparatus immobile, in many of its forms, is peculiarly adapted. Dr. E. D. Hudson, of New York, has applied in similar cases an apparatus of his own construction, made of willow, and secured in place by leather straps. In case the purpose of the apparatus is to encourage bony union, no motion is allowed at the knee-joint.”

This splint was originally furnished a middle-aged lady for an oblique fracture of the lower third of the femur, of which the parts had failed to reunite. After an unsuccessful resort had been had to the introduction of setons, Dieffenbach’s plugs, and other expedients, to excite an action of the opposing surfaces and surrounding tissues favorable to a reunion, it became desirable to furnish the patient a means of exercise in walking. The limb was shortened by overlapping of the fractured part, one and a half inches, sufficient to allow the introduction of an inclined plane under the heel. A bolt passing at right angle through this inclined plane, connecting the splint to the latter, served as the lower point of support afforded by the splint ; while the thigh socket, fitted to the parietes of the thigh, above the fractured part, and extending up beneath the glutei muscles and perineum, constituted the superior point of support. The primary object in this case was to keep the fractured parts in situ —to oppose the threatened protrusion of the superior fragment ; while the final object was to compact the limb in the semi-cylindrical and immobile splint, and with a short splint over the anterior fractured parts, the whole limb being kept in place by strong leather bands, to effect a reunion. The action of the splint was

every way satisfactory, to enable her to have the desired exercise and retain the fractured parts in apposition. What its ultimate effect was I am unable to report,

as the lady went off to a remote part of the country. I anticipated a reunion of the fractured parts if the use of the apparatus should be carefully persisted in. When the limb is not shortened, the inclined plane is dispensed with, and steel straps pass down under the foot, and constitute the lower point of support. Knee and ankle-joints are appended to the splint when desirable.

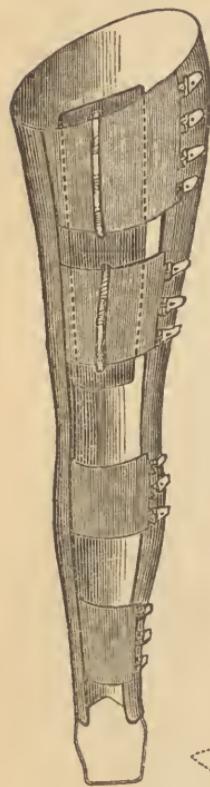


Fig. 1



Fig. 2

SPLINT WITH STEEL STRAPS.

SPLINT WITH INCLINED PLANE.

EXCISIONS OF THE TIBIA.

A modified form of the splint for ununited fractures I have arranged and applied to cases of excision of the tibia with the happiest effect.

Several cases of excision of three to four inches of the tibia, while the fibula and the leg were of the normal length, have been restored to usefulness and locomotion without the aid of a cane by the adaptation of this modified appliance. The *points d'appui* were established in the sole of the shoe and at parts above the excision, while the semi-cylindrical case and leather bands kept the superior and inferior parts of the leg in their relative positions.

The treatment fulfils two indications, viz: allows of the formation of intervening osseous tissue, while it enables the patient to engage freely in his accustomed avocation and locomotion.

THIGHS AND LEGS SHORTENED BY FRACTURES AND EXCISIONS—TREATMENT OF CONTINUED.

During the late war, many cases of extensive fracture of the thigh and leg were produced by gun-shots, in which, by the creditable effort of surgeons, the limbs were saved, but in a condition of great shortness and distortion.

Very many cases of such a character have been assigned to me for compensative treatment, by special orders of the Surgeon General United States Army.

They have resulted very creditably in naturalness of length and appearance and locomotion.

The following *cuts* and history of two cases illustrate many others which I have successfully treated.



Case 1st. J. F., Private Co. F., 127th N. Y. Infantry, wounded in his right thigh by a musket ball, in S. C., November, 1864. The femur was shortened seven inches, and seriously disfigured. The soft tissues were very much damaged and wasted by abscesses, the motion of the knee-joint limited, the foot rigidly extended, arch increased, the whole limb suffering extreme debility and partial paralysis.

To the foot, leg, and thigh, both lengthening and supporting appliance were adapted, which, in full dress, personated his well foot and limb; and on it he walked with great naturalness and

comfort. Six months after the apparatus was furnished, he reported himself as walking ordinarily without the aid of a cane, with scarcely any halting gait, and performing the duties of a watchman, which required much activity.

Case 2d. J. J., Private Co. I, 7th N. Y. Heavy Artillery, was wounded in the upper third of the right thigh, by a minie-ball, at Cold Harbor, Va., June 3d, 1864; was taken prisoner; seven inches of the shaft of the femur were excised from and beneath the great trochanter, the second day after injury. His foot became rigidly extended, its arch very greatly increased, on the one part by morbid contractions, and on the other by partial paralysis. In September, 1865, I furnished extending and supporting apparatus to his foot and leg; a concave splint, with oscillatory joint, to support the injured and debilitated parts of the thigh. The success was very perfect, enabling him to walk on rough ground, in the woods and over fields on hunting excursions.

MORBUS COXARIUS (OR HIP DISEASE) AND CONGENITAL DISLOCATIONS.

The number of those on whom the disease and injury have wrought their baneful results demand an appliance which shall alleviate their irremediable deformities, and enable the sufferer to use and exercise the deformed limb in a manner likely to conduce to health, ease and beauty of dress.

Some fifteen years ago I undertook, for the first time, the treatment of such a case, the applicant being a young lady, and with a success which has continued to the present time a rich reward by its utility and improvement of her general health; since which time the apparatus has been so modified and improved as to be applicable alike to men and women, and proved gratifying to all to whom it has been adjusted. It is light, strong, and durable, and when applied gives the patient the appearance, in dress, length of limb, and action of the foot, of being whole, and enables him to walk a great distance without fatigue.

Numerous cases have been presented for my advice and treatment. One young man of this city, whose limb was shortened six inches, who had been burdened with a heavy cork-boot, which, by its weight and dragging movement, greatly impaired his health and grace of action, says that no consideration would induce him to part with the artificial foot and its salutary effects. One young lady, with her limb shortened eight inches by congenital disloca-

tion and lack of growth, now passes with her schoolmates as being apparently whole. There are many similar interesting cases to whom I am permitted to refer those who may desire such appliance, and to inform themselves of it by seeing its application and action.

EXPLANATION OF CUT.

The deformed limb below the knee is inserted in a light case, accurately fitted to the shape of the leg and ankle. It is retained by soft leather bands, laced in front.

The foot rests on an inclined plane so as to reduce the anterior-posterior distance from toe to heel. A calf-skin boot or gaiter, full at the instep, may then be drawn over the whole, and pants of the usual shape and size can be worn, and will entirely conceal the deformity. All parts are properly padded. The artificial foot corresponds in size with the foot of the other leg. The artificial ankle-joint obviates the excessive limping and physical strain experienced in the use of cork boots and stirrups. It also allows the patient to gain the natural length of step.



APPARATUS FOR EXCISIONS.

The possibility of compensating the osseous structure, powers, and functions of the arm, that have suffered by excision, and restoring it to usefulness, had not been entertained by surgeons in this country prior to the war—neither has it been in Europe. Even previous to 1862—when I was first incited by the application of a volunteer soldier, with nearly five inches of his arm and fore-arm resected, to study up an apparatus which should restore his arm to usefulness—a supporting splint was all that had been expected.

The apparatus which I furnished him—and a like case soon after—so far restored the fore-arm to the exercise of its normal powers as to enable the patient to carry a dumb-bell of many pounds weight, with the arm and fore-arm extended at a right

angle with the body, and thence by flexion to his head, and to engage with his accustomed usefulness in his usual vocation as a farmer.



EXSECTION OF THE ELBOW.



EXSECTION OF THE ELBOW TREATED.

The successful issue of the case being reported to the Surgeon-General of the United States army, special orders were given for apparatus to be furnished for other cases—of excision of the head and shaft of the humerus, of the entire humerus, etc. Their treatment was followed by the detailing of a Board of Surgeons to examine the merits of the apparatus. The apparatus presented—its artistic beauty, the scientific and anatomic principles observed in its construction and adaptation, the physiological functions which it supplies either in whole or part, and its great practical success—secured for it an extended consideration. It received the highest personal encomiums of the members of the Board, and was deemed of such importance as to merit a separate commission. This commission applies to all cases of resection—of the humerus—ulna and radius—as well as of the joints.

I have been the first to propose to the profession the treatment of resections of the elbow and shoulder with compensative apparatus. One hundred and thirty cases in military and civil practice have been successfully treated during the past three years. To supply lost leverage, to give rigidity to the muscles, to restore the

functions of flexion, extension, pronation, and supination—impaired by wounds of the muscles or motor nerves—and leave the arm in a condition favorable to the reproduction of bone, and possible reunion, are the objects sought and obtained by this apparatus. It is destined to work a great change in the operative surgery of the superior extremity. With its introduction, the only objection to resection—uselessness of the mutilated arm—is obviated. This operation will be almost exclusively substituted for amputation.

A more extended treatise on resections, and their treatment with apparatus, is contained in a Monograph—"Remarks on Exsections, with Cases and Plates, by E. D. Hudson, M. D., New York." The above monograph contains descriptions of ten selected cases of resections, including resections of the shoulder and elbow-joints, resection of the entire humerus and heads of the ulna and radius, resection of the upper, middle, and lower thirds of the humerus, and resection of the ulna and radius.

These cases, viewed individually and collectively, throw much light on the many questions of expediency—the comparative success and utility of different modes of incision, the retention of a single articular surface, &c.—involved in the subject of resection; while the application of apparatus, of recent suggestion, demanding the retention of every power and function of nerve and muscle, so far as is possible, sets aside the modes of operating formerly employed, which, seeking no such end, mutilated both, looking only to the successful removal of bone, speedy healing, and the formation of a false joint or intervention of ankylosis.

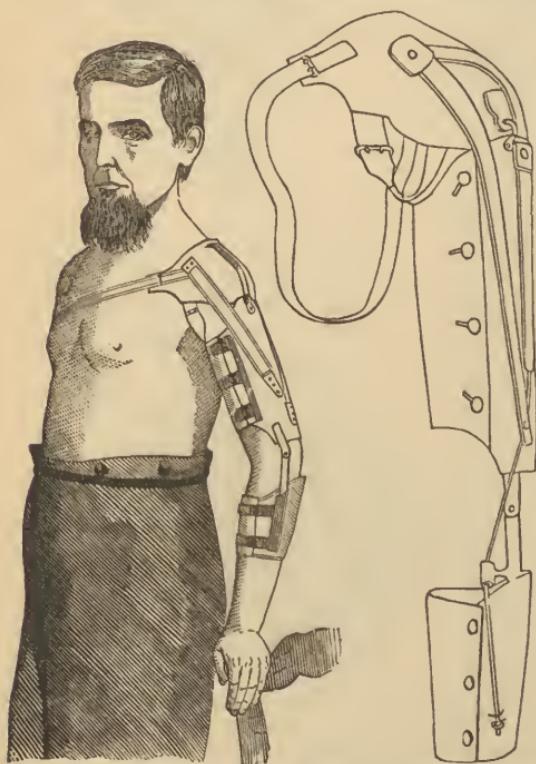
The apparatus, or rather the system of apparatus—for each case demands an individual appliance, modified by the combination of site, mode, and extent of operation, and the number of



CASE OF RESECTION OF THE SHOULDER-JOINT.

functions retained or impaired—is not intended to act upon the injured arm as a passive object alone, but to facilitate the use of every power and the exercise and ultimate restoration of lost vigor and impaired functions.

Where no vital nerves or important muscles have been severed, its usefulness is immeasurably augmented rather than obviated, as has been erroneously supposed. It retains the different parts at their natural distances from each other, supplies the place of the removed bone for leverage, holds the muscles within their proper limits, and augments their power by compressing them, as the pugilist bands his arm. A patient with resection at the elbow, when the insertions of the brachialis anticus, biceps, and triceps, have not been impaired, can pull forcibly and carry much weight in a vertical line, but with an apparatus he can in time raise heavy weights to the head, strike powerfully, and perform all that necessity requires with ease. Hence the superiority of its use to reliance on ankylosis or the formation of a false joint.



RESECTION OF SHOULDER WITH APPARATUS APPLIED. APPARATUS FOR RESECTION OF SHOULDER.

The weight of the entire arm being suspended by the apparatus, the injured, debilitated, and atrophied muscles of the shoulder are not only relieved of that burden, but are thickened up by the support afforded by the appliance. By exercise they soon begin to gain tone and contractility, and to regain their natural strength. The truncated humerus is drawn upward to a greater or less extent in proximity to the glenoid cavity—in some instances in juxtaposition with it, or the acromion process, where a false joint is formed by ligamentous tissue of sufficient strength and motion, to permit, in process

of time, the disuse of the apparatus entirely or in part. By such treatment I feel assured that many cases of extreme excision of the humerus will eventually subject the patient to little or no inconvenience, except by the loss of length. In no instance should the arm or fore-arm be sacrificed by an amputation, except when the vital tissues have been destroyed by injury, or are involved in malignant disease.

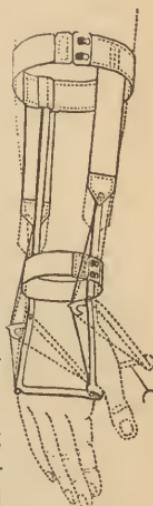
EXTENSOR APPARATUS FOR THE WRIST.

THE EXTENSOR, *Carpi Digitorum* (see eut), is a light, simple and efficient instrument, designed for the extension of the wrist and hand, in cases of paralysis of the extensor muscles of those parts, in the not infrequent occurrence of what is termed "wrist-drop," which is occasioned by injuries to the nerves, by gun-shot wounds, operations of excision, or by lead poisoning and other forms of disease. Such cases I have often been required to witness, and furnish mechanical means to extend the hand, antagonize and alternate the action of the flexor muscles of the wrist, hand, and fingers.

This little apparatus has proved every way efficacious.

In its incipient use the action is representative; its therapeutic influence is to produce primary passive action; subsequently it serves to aid volition and a sanitary condition. Its levers, joints, stanchions, cords and rubber springs are very reliable aids, can be increased in power as occasion requires, to restore the hand to the exercise of its natural functions.

In a number of such cases resulting from gun-shot injuries it has been applied with great benefit.



EXTENSOR APPARATUS.

ARTIFICIAL HANDS AND ARMS.

FOR AMPUTATIONS AND CONGENITAL DEFECTS.

The hand and arm are new and successful imitations of the natural ones; every joint and the contour of the fingers, wrist, and elbow being retained in their construction. They possess the functions of flexion and extension, for grasping and holding, and

for every service which *intelligence* can expect in an artificial hand and arm. The many who have availed themselves of this beautiful and valuable device are well pleased with it, not only for its perfect imitation of the natural hand in dress, but for its efficient service, especially in an amputation of the



fore-arm. Plaster Paris casts of the unamputated hand and arm, and of the stump, are essential for governing the size and symmetry in the construction of the artificial ones. A very beautiful and serviceable hand is made for congenital malformations of hands and arms.

HONORARY TESTIMONIAL TO THEIR MERIT.

I have never presented these arms in competition for United States patronage. Their delicate mechanism and artistic finish render it impossible to furnish them at Government prices.

My desire to supply apparatus of first-class workmanship and utility only, and my conviction of the secondary usefulness of even the best artificial arms, debarred me from the construction of an inferior article. Such, however, are made by others, and are of some practical utility. To the Board of United States Surgeons, convened in New York in 1864, in connection with other surgical apparatus presented for adoption by the Government, and for which I received commissions, I exhibited the artificial hand and arm as a scientific, ingenious, and artistic piece of mechanism, and to illustrate my interest in every department of mechanical surgery, and my ability to treat every form of mutilation in this as well as in its many other branches with perfected apparatus. It was carefully studied and admired, and received honorary mention in the Report of the Board to the Surgeon-General, as being a work of art for lightness, grace of action, naturalness of dress and utility, superior to all others.

Expressions of the Profession.

FROM THE LATE DR. VALENTINE MOTT.

No. 1 GRAMERCY PARK, N. Y., March 26, 1862.

Dear Sir: I am gratified to find that you are giving your attention to what may properly be called Mechanical Surgery. As a regularly educated professional man you can repair the mutilation which surgery has to make much more effectually than the mere mechanic. It will give me pleasure to take advantage of your skill in the arrangement of surgical appliance.

Yours, truly,

VALENTINE MOTT, M. D.,

*Emeritus Prof. of Surgery in the New York University, &c.;
Surgeon to Bellevue and St. Vincent's Hospitals, &c.*

Dr. HUDSON.

NEW YORK, March 24, 1865.

E. D. HUDSON, M. D., the successor of Messrs. Palmer & Co. in the manufacture and application of artificial limbs, I have known many years. Many of my patients have had the advantage of his skill, and he has given unfailing satisfaction. I believe him fully entitled to the confidence of the profession and the public.

WILLARD PARKER, M. D.,

*Prof. Surgery, College Physicians and Surgeons;
Surgeon to Bellevue and New York Hospitals.*

14 EAST SIXTEENTH ST., N. Y., March 27, 1865.

Dear Sir: I am much gratified to learn that you still continue to devote your attention to the mechanical part of Surgery, which has for its aim the substitution and perfection of artificial limbs, to take the place of those on which disease has made the severe operation of removal necessary. Your education as a physician and surgeon enables you to carry out the indications which the peculiarities of individual cases must present, and thus the profession, and patients who have been so unfortunate as to have required amputation, will have the advantage of your mechanical ingenuity, as well as of your scientific acquirements.

The perfection to which the artificial limbs you are now engaged in manufacturing have been brought, and their recognized utility, place them among the valuable additions which intelligence and civilization have, in recent times, supplied for the amelioration and benefit of humanity. The professional com-

munity will undoubtedly avail themselves of your capabilities in your special vocation, as I shall assuredly do when occasion requires.

Very truly yours,

J. M. CARNOCHAN, M. D.,

DR. E. D. HUDSON.

*Prof. of Clin. Surg. N. Y. Med. Col.;
Surg.-in-Chief to the State Emigrant Hospital, &c.*

No. 121 TENTH ST., N. Y. March 27, 1865.

The undersigned, from personal knowledge of Dr. E. D. Hudson's skill and success in the adaptation of artificial substitutes for amputated limbs, takes pleasure in recommending him to the patronage of the profession, and of all who stand in need of his services. The high esteem enjoyed by Dr. H. hitherto in his professional relations, as well as his skill and experience acquired in the special department to which he devotes himself, entitle him to confidence and respect.

GURDON BUCK, M. D.,

Surg. to N. Y. Hospital and St. Luke's Hospital.

NEW YORK, March 26, 1865.

My Dear Sir: I am gratified to know that you have formally adopted, as a specialty, the replacing of mutilated limbs, etc., by mechanical appliances. By bringing this duty to humanity properly within the pale of your profession, a step is gained in advance. It will give me pleasure to avail myself of your advice and assistance when occasion offers. Your entire success with the two cases of Syme's amputation at the ankle-joint was equally gratifying to my patients and to myself.

Most truly yours,

WILLIAM H. VAN BUREN, M. D.,

DR. E. D. HUDSON.

Surg. to New York Hospital, etc.;

Prof. of Anatomy in New York University.

From personal knowledge of your success in supplying useful artificial limbs, I cordially indorse the sentiments of Dr. Van Buren.

JAMES R. WOOD, M. D.,

Surg. to Bellevue Hosp. and Prof. of Surgery, etc.

No. 4 EAST 17TH STREET, N. Y., Aug. 22, 1865.

I have now for many years employed Dr. E. D. Hudson's artificial limbs, and have had every reason to be well satisfied with their performance. In amputations at the knee and ankle-joint his appliances are admirable, and I know of no superior artificial limb to that which he adapts to stumps made in the continuity of the leg.

T. M. MARKOE, M. D.,

Surgeon to New York Hospital; Prof. Adj.

College Physicians and Surgeons.

NEW YORK, August 21, 1865.

My Dear Sir : I take pleasure in adding to the many expressions of approval which you have already received from the profession. But I wish here to make particular mention of your specialty in the adaptation of an apparatus to supplant the clumsy shoe worn by patients who have suffered amputation at the ankle-joint, whether after the method of Syme or Pirigoff. From time to time I see the soldier on whom Pirigoff's operation was performed in the field, and who still wears your apparatus much to his satisfaction. The two cases of Syme's operation are also much gratified with their new feet, and walk without a halt.

I have also examined, with no little interest, your apparatus for the excision of the elbow-joint; I consider its introduction calculated to encourage surgeons in their efforts at conservative surgery of the upper extremities.

In conclusion, permit me to express my satisfaction at the interest and kindness you have manifested in the patients sent you from the Central Park U. S. Hospital, during the period of my administration of that institution. Hoping you will continue as untiring in your well-directed efforts in Mechanical Surgery, and wishing every success,

I am, sir, very respectfully,

Your obedient servant,

J. W. S. GOULEY, M. D.,

Demonstrator of Anatomy, University Medical College, N. Y., and Surgeon to Bellevue and St. Vincent's Hospitals, N. Y.

To. E. D. HUDSON, M. D., Clinton Hall, N. Y.

I have been long acquainted with Dr. Hudson, and have for many years recommended my patients to him for artificial limbs. While in charge of the U. S. General Hospital in Central Park, organized for the reception of soldiers requiring artificial limbs, my opportunities for judging of his skill were unusual.

I do not hesitate to recommend all of his work; but I desire to call especial attention to his very ingenious mechanism for the support of limbs on which resections have been practiced.

FRANK H. HAMILTON, M. D.,
Prof. Military Surgery, Bellevue Hospital, Medical College, New York.

64 Madison Avenue, N. Y., Aug. 22, 1865.

NEW YORK, August 25, 1865.

Dr. E. D. HUDSON.

Dear Sir : It gives me great pleasure to certify to the practical utility of the artificial limbs which you have applied to patients under my observation. Your appliance to stumps in amputations at the ankle-joint, by Syme's method,

has, in my experience, been the perfection of usefulness. In the case of Kate Riley nothing could have been more satisfactory; not only could she walk without embarrassment, but no imperfection in her gait was perceptible. She performed her duties as nurse in Bellevue Hospital for several years, running up and down stairs, walking great distances, without her peculiar disability becoming known, either to her associates or to the Resident Medical Staff.

While connected with the U. S. General Hospital at Central Park, I had abundant opportunities to study the results of the application of artificial limbs, and the uniform satisfaction which your appliances gave impressed me with their practical value.

Yours, truly, STEPHEN SMITH, M. D.,
*Surgeon Bellevue Hospital; Prof. of
 Principles Surgery, Bellevue Hosp. Med. Col., etc.*

NEW YORK, Aug. 24, 1865.

Dr. E. D. HUDSON,—*Dear Sir:* During two and a half years' service at U. S. A. General Hospital, Central Park, New York, I have very frequently examined the different mechanical appliances which you have furnished to the mutilated soldiers, and have been most favorably impressed with the skill, judgment and care with which they have been arranged; but I would especially mention the excellency of your artificial foot for amputations at the ankle-joint, and your apparatus for resections of the elbow and shoulder-joints, also that for exsection in continuity of the humerus. I feel fully satisfied that by your ingenious mechanical treatment of resections of the upper extremities many limbs have been made exceedingly serviceable which otherwise would have remained comparatively useless; and that no artificial arms can perform the functions which these limbs do with the assistance of such apparatus.

Very respectfully yours, S. TEATS,
Late A. A. Surgeon U. S. A.

UNITED STATES ARMY AND NAVY.

FROM DR. R. S. SATTERLEE, BRIG.-GEN. U. S. A., MEDICAL PURVEYOR, ETC.

I have been for several years conversant with Dr. E. D. Hudson's efforts in the cause of conservative surgery, and have seen his appliances for the benefit of not only those who have suffered the loss of legs and arms, but especially his apparatus for operations at the ankle after the manner of Professor Syme, and in restoring action in resection of joints; and I think the Medical Profession and the public are under great obligations for his perseverance, and the degree of perfection to which he has brought his substitutes for nature in those cases. It gives me great pleasure to make this statement.

R. S. SATTERLEE, M. D.,
Brig.-Gen. and Medical Purveyor U. S. A.

MEDICAL PURVEYOR'S OFFICE, {
 New York, Aug. 24th, 1865. }

OFFICE OF THE CHIEF MEDICAL OFFICER, }
 New York, January 28, 1867. }

While Medical Director of the Department of the East, I was in constant business relation with Dr. E. D. Hudson, Manufacturer of Artificial Limbs and of Mechanical Appliances, etc., for resections.

In my whole intercourse then and since I was well satisfied with his entire ability and anxiety to do justice to the soldier and the Government.

Being a medical man, he united professional skill with mechanical knowledge and gave great satisfaction. His mechanical appliances for resection were a specialty, and proved remarkably successful.

WM. J. SLOAN,
Surgeon U. S. Army;
Brig.-General, Chief Med. Officer, N. Y. City.

MEDICAL PURVEYOR'S OFFICE, }
 Philadelphia, Jan. 29, 1867. }

While on duty as Medical Director Department of the East, at New York city, for about two and a half years, I gave many orders for artificial limbs and mechanical appliances upon Dr. E. D. Hudson. It was my practice always to examine personally the limbs and appliances before they were accepted, and I can therefore testify intelligently to the honesty and faithfulness with which the orders were filled. The artificial limbs and apparatuses for resections supplied by Dr. Hudson gave entire satisfaction, and I heartily concur in the opinion given by Gen. Sloan.

C. McDougall,
Brig.-Gen. U. S. Army, Medical Purveyor.

U. S. NAVAL HOSPITAL, N. Y., }
 Brooklyn, Aug. 25, 1865. }

Dear Sir: I have been much gratified with the result of your treatment of the numerous cases of mutilation sent you from this hospital.

Your professional knowledge, with your mechanical skill, has enabled you to furnish the most perfect relief to each particular case; and the results must have been exceedingly gratifying to the recipients.

I can, therefore, fully recommend you to all those who may have the misfortune to lose the use of their limbs by exsection or amputation, for the mitigation of their afflictions, as far as human means can.

Very respectfully,

Your obedient servant,

THOS. L. SMITH,
Surgeon U. S. N., in charge of Naval Hospital.

To E. D. HUDSON, M. D.,

Clinton Hall, Astor Place, New York.

COMMISSIONS FOR ARTIFICIAL LIMBS.

By the Surgeon-General of the United States Army.

At the outset of the war, the *American Medical Times* proposed that the United States should make appropriations of money to furnish artificial limbs for soldiers who had lost their legs and arms in the service. Congress made appropriations, and referred the entire matter to the Surgeon-General of the United States Army.

Three Boards of Surgeons were convened at different periods during the war, who patiently and deliberately examined every artificial limb which was presented for their investigation of its merits. The respective boards were composed of Dr. Valentine Mott, New York; Dr. R. S. Satterlee, U. S. Army, Medical Purveyor; Dr. — Baehe, U. S. Navy; Dr. Wm. H. Van Buren, New York; Dr. — Gross, Philadelphia; Dr. — Warren, Boston; Dr. C. McDougall, U. S. Army, Medical Director; Dr. A. B. Clement, U. S. Army; Dr. J. Simons, U. S. Army; Dr. Hewitt, New York.

From some thirty varieties of limbs only eight were selected and recommended by the different boards, for the Commission of the Surgeon-General, to be furnished to soldiers.

The following are the Commissions which my own apparatus received:

SURGEON-GENERAL'S OFFICE,
Washington City, D. C., May 13, 1865. {

Dr. E. D. HUDSON, New York City.

Sir: In accordance with the recommendation of a Board of Medical Officers, recently convened in the city of New York, you are authorized to furnish to mutilated soldiers, upon the order of the Medical Director of a Department, *Artificial Legs*, of the approved pattern presented by you to the Board.

By order of the Surgeon-General.

Very respectfully your obed't servant,

W. C. SPENCER,
Ass't Surg. U. S. Army.

N. B.—This is the third commission granted by the United States to Dr. Hudson, *who has furnished artificial legs to the Government during the war.*

SURGEON-GENERAL'S OFFICE,
Washington City, D. C., May 13, 1865. {

Dr. E. D. HUDSON, New York City.

Sir: In accordance with the recommendation of a Board of Medical Officers, recently convened in the city of New York, you are authorized to furnish to mutilated soldiers, upon the order of the Medical Director of a Department, *Artificial Feet*, of the approved pattern presented by you to the Board.

By order of the Surgeon-General.

Very respectfully your obed't servant,

W. C. SPENCER,
Ass't Surg. U. S. Army.

N. B.—Dr. Hudson is the only one commissioned to apply Artificial Feet in cases of Syme's Operation at the ankle-joint.

SURGEON-GENERAL'S OFFICE, }
 Washington City, D. C., }
 May 13, 1865. }

Dr. E. D. HUDSON, New York City.

Sir :—In accordance with the recommendation of a Board of Medical Officers, recently convened in the city of New York, you are authorized to furnish to mutilated soldiers, upon the order of the Medical Director of a Department *Apparatus for Resection of Elbow and Shoulder Joints*, of the approved pattern presented by you to the Board.

By Order of the Surgeon-General.

Very respectfully your obed't servant,

W. C. SPENCER,
Ass't Surg. U. S. Army.

SPECIAL COMMISSIONS.

Numerous cases of extreme mutilations of the femur by comminuted fractures; excisions, distortions, ununited fractures, destruction of muscular tissues, extensive shortness, partial ankylosis, excisions of the tibia—of tibia and fibula—fractures and distortions of the feet, partial paralysis of extensor and flexor muscles; excisions of carpal end of radius, paralysis of extensor muscles of the hand—have been assigned to me for special treatment with apparatus adapted to each individual case, by the special orders of the Surgeon-General of the United States Army.

Their treatment with surgical apparatus—in a majority of cases improvised to fulfil indications—resulted very successfully.

SOLDIERS AND SAILORS

who have lost their limbs, or suffered resections of their limbs while in the service of the United States, and have not been furnished ARTIFICIAL LIMBS, or APPARATUS, by the United States, are entitled to the VERY BEST, free of expense to themselves, and also TRANSPORTATION to and from the place where the limbs are provided.

To obtain such limbs, apparatus and transportation, they must make application for the limb, or apparatus, and send—

1. Their discharge paper; 2. Officer's certificate and affidavit; and 3. The soldier's own affidavit; which papers are delivered to the Medical Director of the Department of the East, who will issue an order to have the limb or apparatus furnished, and thereupon return the discharge paper, accompanied with transportation papers. The soldier, if he prefers, can make his application and

send his papers to the Medical Director of the Department in which he resides.

SPECIAL CASES of damaged limbs, as ununited fractures, shortened legs by comminuted fractures, excisions, distortions, extensive lesions of muscles, injury of nerves, and partial paralyses, are furnished on application, with necessary papers, by REFERENCE to the Surgeon-General of the United States Army for his special consideration, and special order, with mechanical apparatus.

Every application made to myself will be speedily attended to, and the entire wishes of the patient gratified.

SANITARY CONDITION OF STUMPS,

FOR THE APPLICATION OF ARTIFICIAL LIMBS.

They should be entirely healed, the cicatrix strong and healthy. The joints retained should be free in their movements for normal extension and flexion. The contraction of flexor muscles of either the thigh or leg stumps, though often extreme, is readily overcome by a little persevering effort, except where the muscles have been much injured, and abnormal adhesions have occurred; which condition must be accommodated or modified, if it cannot be remedied.

When chronic disease, debility, wasting, and laxity of tissues have occurred, either before or subsequent to the amputation, gentle and even bandaging of the entire stump should be practiced and persevered in till the artificial limb has been applied—to not only compact and give tone to the soft parts, but to make the stump slightly and evenly tapering.

Ablutions and affusions with cold water, night and morning, and friction with the hand, are valuable expedients to create a quickened and healthy condition.

The mechanical stimulus of the socket and exercise of an artificial leg oftentimes relieve the stump of neuralgic pains, unless the nerves are involved in cicatrices or disease. Diagrams are sent to patients for measurements. Patients can economize both time and expense by sending their measurements, which their physician can take, and a statement of their case, before they come for the adaptation, trying and completion of their limbs—AS EVERY LIMB AND APPARATUS IS MADE TO ORDER.

Testimonials of Patients.

Certificates are so readily obtained from patients for even the most inferior articles, and such gross deception has been practiced in their use, that I am induced to give only a few cases as exponents of the general satisfaction afforded by my treatment and apparatus, and its decided usefulness.

CASES

ILLUSTRATIVE OF THE VALUE OF ANKLE-JOINT AMPUTATIONS.

CASE I.—J. E. A., Private Co. E., 8th N. Y. Cavalry. Wounded in the foot comminuting the tarsus, July, 1863. Amputation of the ankle-joint—Syme's method—same day of injury, on the field. Oct. 18, 1863, transferred to Central Park U. S. General Hospital. Stump much swollen; tissues thickened, ulcerated, with indications of incipient necrosis. Appearances unfavorable. By good treatment the stump became healthy, though damaged some by abscesses. In January, 1864, I furnished apparatus for the case. The incipient use was satisfactory. Soon after he returned to the army associated with a sutler. He is now engaged as a clerk in the War Department, and informs me that in every appearance—standing, locomotion, dancing—he passes for a whole man. Can walk all day and feel no inconvenience. “I can only say I have two good legs.”

CASE II.—P. C., Private 7th Mich. Vols. Suffered amputation of his ankle-joint. In October, 1866, I furnished him a foot. Incipient use very creditable, with entire weight on the end of his stump. At first trial he experienced a slight prickling, a temporary sensation. Nov. 11th, 1866, day after he returned home, he walked three miles with comfort; sensations all normal. The more he uses his foot the better, and feels every way whole and competent for his farming.

CASE III.—W. D., Private 6th Wisconsin Vols. Suffered amputation of the ankle-joint; Syme's, modified by dorsal flap. Apparatus, adapted to Plaster Paris cast of stump, and sent by express, was applied 1st November, 1866. In December, after thirty days' use, he wrote: “The adaptation was perfect. I applied the foot—got up and walked with perfect ease and naturalness. I have traveled five miles continuously with it and experienced no fatigue. I am light-house keeper, and find it of inestimable value in going up and down stairs, of which I have much to do.”

LEG AMPUTATIONS

are the most common, and their compensation is uniformly successful and pleasing.

Mr. P., civil engineer, has been in use of the artificial leg I furnished him fifteen years ago. Is in active duty, surveying out routes for railroads; traveling over hills and valleys; climbing precipices, and performing the various fatiguing duties of his profession. He never uses a cane. Residence, New York city.

Mr. M., late soldier N. Y. Volunteers, lost his leg in the war. He is furnished an artificial leg by the Government. Has returned to his farm, is on his feet same as other farmers, from morning till night, in summer and winter. He stands in his lot apparently well, and ordinarily uses no cane.

OF LEG AMPUTATIONS.

OF THE UPPER THIRD.—The following cases illustrate the value of the knee support, when the stump is flexed upon the thigh at a right angle, in conjunction with an apposite artificial leg, *viz.* :

H. K. D., *Farmer, Schuyler, N. Y.*, lost his limb in the United States service; informs me that he with his brother did all of the work on a dairy farm of 180 acres (except ten days of hired labor), milked fifteen cows, plowed, hoed, raked, and pitched hay, same as when he was whole; and in the winter loaded in the woods heavy logs, alone rolling them up, and drawing them to the saw-mill. He has worn the leg three years.

M. Moses, *Carpenter, Wisconsin*, lost his leg at its upper third, in the United States service, and uses a knee-supporting artificial leg. He informs me that he works at his trade, as formerly, and frequently walks six and eight miles to his place of work. That he lifts as heavily as ever upon his limbs, upon which he is standing or walking much of his time. He has used his artificial leg three years without repair.

OF KNEE-JOINT AMPUTATIONS.

Twelve consecutive cases, for which I have applied artificial limbs, the success has been invariably useful and pleasing. M. Conroy, who suffered amputation of his knee-joint eleven years ago, writes that he has used the artificial limb I furnished and adapted to the condyles of his stump ever since, and at continual hard work, with great command.

Miss T. suffered an amputation of her leg, near the head of the tibia, in 1859, for a complete ankylosis of the knee-joint. She writes: "I walk and work upon the limb you furnished me as I never expected to again. I am very happy in my new life. Use no cane, and walk as my companions do."

SINGLE THIGH AMPUTATIONS.

C. L., 2d Lieut. Vet. Res. Corps, promoted from private, after the artificial limb was applied; stump very bad, caused by extensive and almost fatal gangrene—says: "I have been on constant duty in Tennessee since April, 1864, one month after the artificial limb you furnished me was applied. I have walked long distances, have been able to ride horseback nearly if not quite as well as ever I could. The leg has more than given satisfaction. The leg is to-day as good as ever." Has used his leg nearly three years.

Lieut. Neidhart says: "I am navigating with this walking machine of yours excellently well, and write you to-day only to express my gratification and thanks." Oct. 25, '66.

H. C. D'W., First Sergt. U. S. Vet. Reserve Corps, walks nearly four miles within an hour. Since his limb was furnished has been in active U. S. service three years, and promoted from a private to first sergeant for his services.

DOUBLE THIGH AMPUTATIONS.

1. C. N. L., late Co. K, 1st Vermont Cavalry. One *thigh* amputated, and one *knee-joint* amputated, July —, 1863. Writes August 23, 1866: "I am doing finely with the pair of artificial legs, and the aid of canes. I keep improving. I find no difficulty in getting off or on railway cars, and steamboats; and in getting about quite independently. I suffer no irritation of my stumps; and after more than one year's experience, and comparing my limbs with every other kind, I am satisfied with my selection. Bridport, Vt."

BOTH THIGHS AMPUTATED.

C. G. R., at St. Luke's Hospital, wounded in battle at Petersburgh, 1865. February 22d, '66, writes to me that he can use his legs very well with the use of canes; get up and down stairs with a cane and railing; walk out of doors; and regards the limbs of great benefit for walking or sitting. To which Rev. Dr. Muhlenburgh, Pastor and Superintendent, appended that the above statement was correct, that Dr. Hudson had done more for Mr. R. than he believed possible.

Mr. J. S. Sanford lost his legs in 1851, and was furnished a pair of artificial limbs by me; one for the thigh, with an artificial knee-joint, and one for the leg amputation, which he is now using. He never uses but one cane, and about his ordinary business no cane. He is on his limbs most of the time as freight agent, and in other active duties. He goes up and down stairs with great facility, and is considered one of the most valuable of the men in the employ of the N. J. Central Railroad Co.

[SEE CUT.]



SANFORD'S CASE.

TO LADIES.

Reference, and Special Information concerning the Artificial Limbs, and other Appliances, and Advice, will be furnished to any Lady who applies for them.

Pamphlets are sent gratis.

Ladies who apply for Limbs, or Apparatus, receive courteous and kind attention, and also every assistance desired to obtain pleasant and inexpensive homes when they visit the City.